

INCOHERENT LIGHT-EMITTING DEVICE APPARATUS
FOR DRIVING VERTICAL LASER CAVITY

CROSS REFERENCE TO RELATED APPLICATION

This is a continuation-in-part of commonly assigned U.S. Patent
5 Application Serial No. 09/832,759, filed April 11, 2001, ^{Pat. 6,658,037} entitled "Incoherent
Light-Emitting Device Apparatus for Driving Vertical Laser Cavity" by Keith B.
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FIELD OF THE INVENTION

The present invention relates to the field of light-emitting devices,
10 in particular, to organic-based solid-state lasers.

BACKGROUND OF THE INVENTION

Over the past number of years, there has been increasing interest in
making organic-based solid-state lasers. The lasing material has been either
15 polymeric or small molecule and a number of different resonant cavity structures
were employed, such as, microcavity (Kozlov et al., U.S. Patent 6,160,828),
waveguide, ring microlasers, and distributed feedback (see also, for instance,
G. Kranzelbinder et al., Rep. Prog. Phys. 63, 729 (2000) and M. Diaz-Garcia et
al., U.S. Patent No. 5,881,083). A problem with all of these structures is that in
20 order to achieve lasing it was necessary to excite the cavities by optical pumping
using another laser source. It is much preferred to electrically pump the laser
cavities since this generally results in more compact and easier to modulate
structures.

A main barrier to achieving electrically-pumped organic lasers is
25 the small carrier mobility of organic material, which is typically on the order of
 $10^{-5} \text{ cm}^2/(\text{V}\cdot\text{s})$. This low carrier mobility results in a number of problems.
Devices with low carrier mobilities are typically restricted to using thin layers in
order to avoid large voltage drops and ohmic heating. These thin layers result in
the lasing mode penetrating into the lossy cathode and anode, which causes a large
30 increase in the lasing threshold (V.G. Kozlov et al., J. Appl. Phys. 84, 4096
(1998)). Since electron-hole recombination in organic materials is governed by